

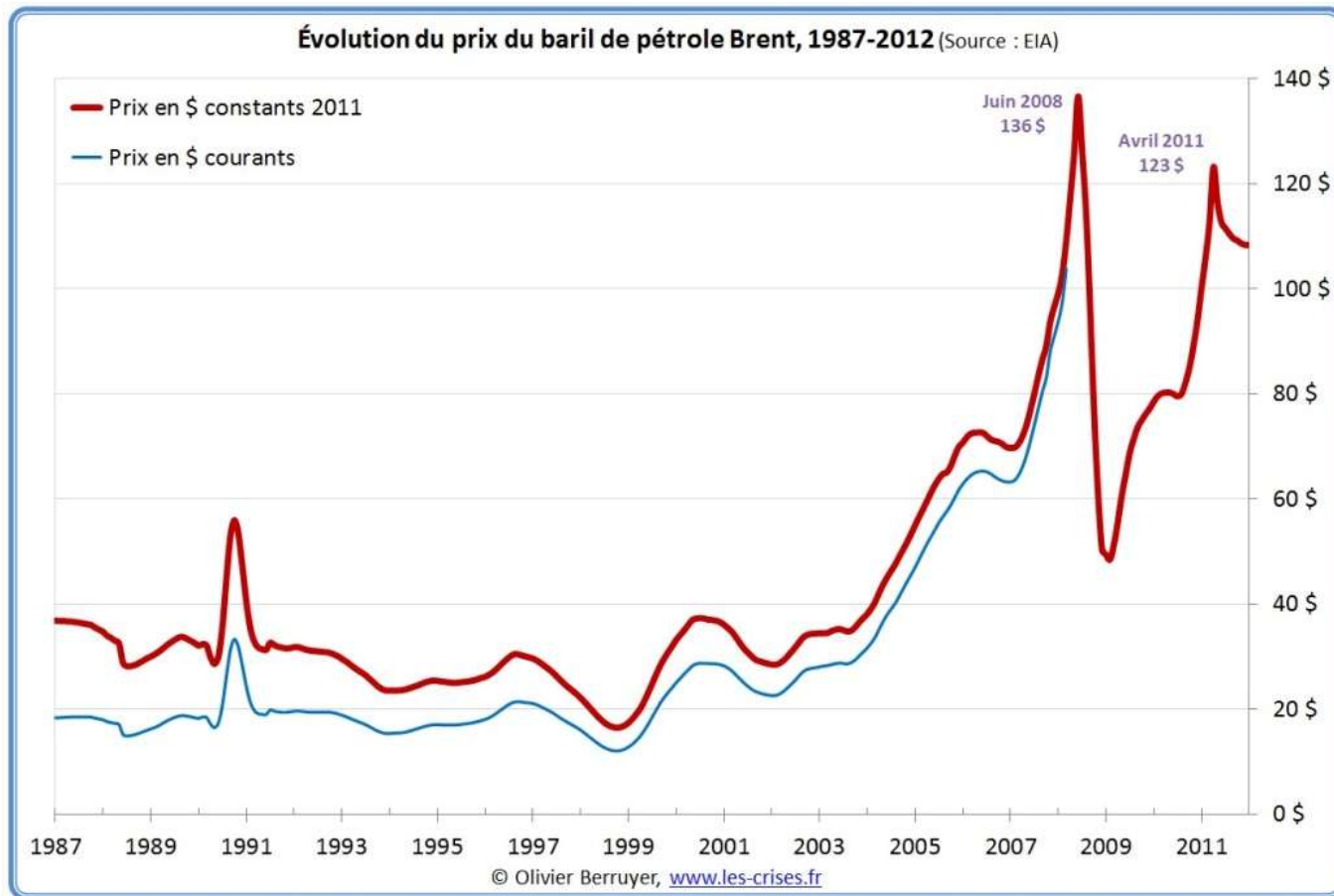


**For a sustainable development through renewable energy in the MENA region : what kind of inter-sectorial integration is needed?**

**Saïd Mouline**  
*CEO of ADEREE*



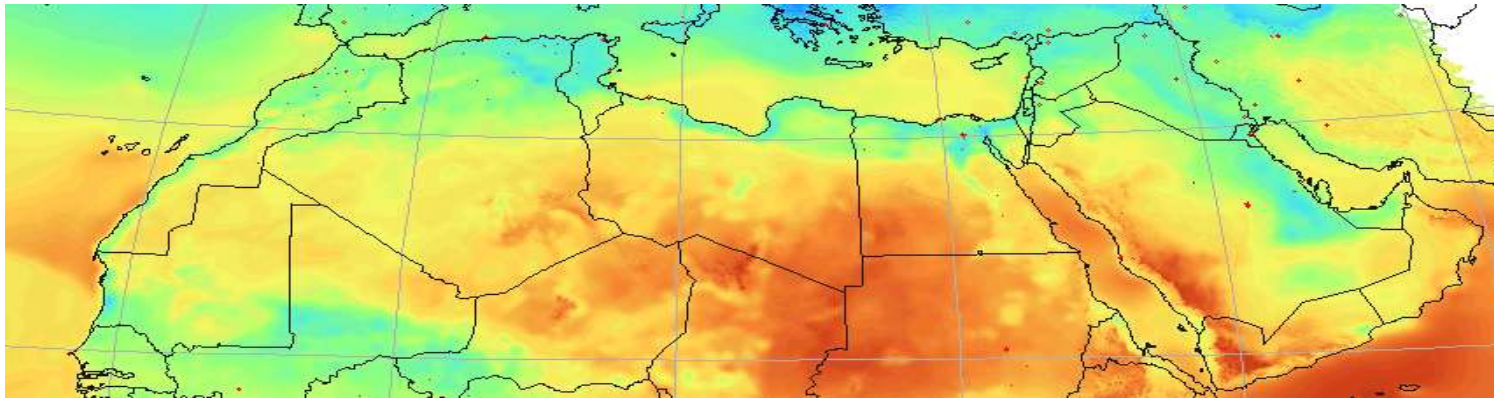
# Oil prices



**High priority issue for MENA non producing countries**



## The Mena region

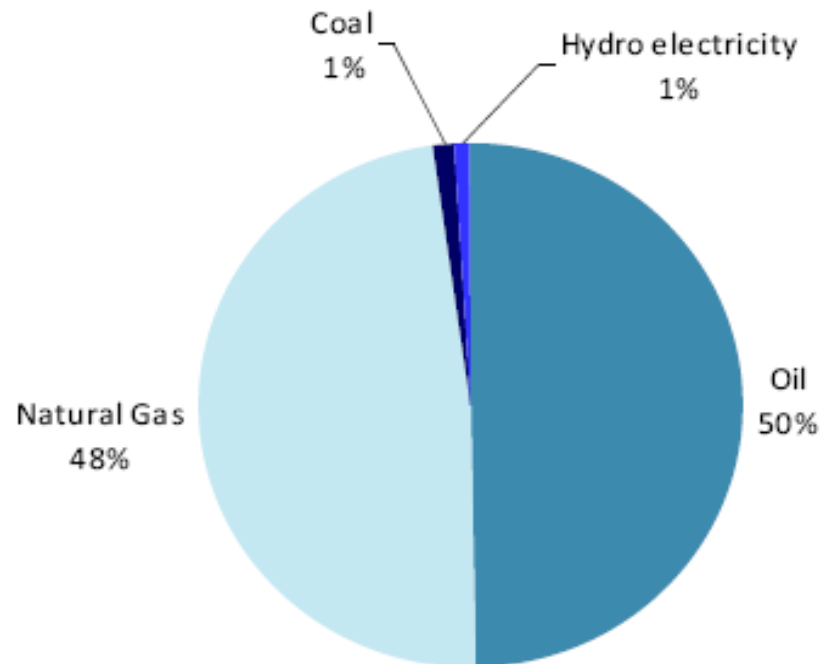


- ❑ Energy is a critical element to the achievement of all social, economic and environmental aspects of sustainable development
- ❑ The key issues of energy for sustainable development:
  - ❑ increasing access to modern energy services
  - ❑ improving energy production and energy efficiency
  - ❑ promoting the use of renewable energy resources
  - ❑ developing cleaner fossil fuel technologies



## Low RE integration

Exhibit 2: Primary energy consumption in MENA\* by fuel, 2009



*Source: BP statistical review of World Energy 2010, \*Includes the Middle East region, Algeria and Egypt*

**Hydroelectricity is the only well-developed, non-fossil fuel form of electricity generation in the MENA region (Morocco, Egypt, Syria).**



# Morocco's RE strategy

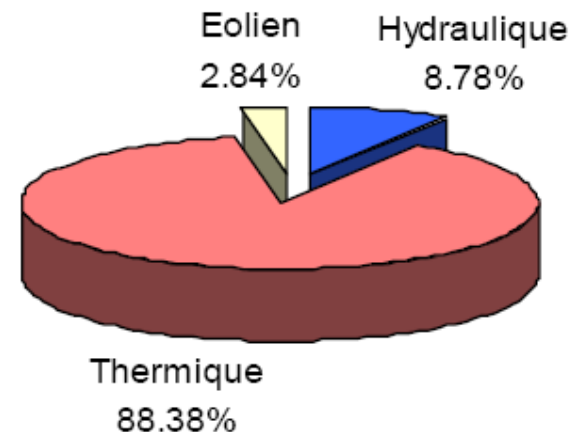
**Context :** 97% of our energy consumption are imported

## **Strategy :**

- ❑ RE and EE high energy priority
- ❑ 2000 MW solar program : 4500 GWh per year, 9 billion USD, 10 000 hectares dedicated, 5 sites, First plant : Ouarzazate – 2015
- ❑ 2000 MW New wind farms programs : produce 6600 GWh per year , 5 sites, savings of 2.5 million tons oil equivalent of fossil fuels, 3.15 Billion \$
- ❑ Energy Efficiency national program : national audit of hospitals, hotels, public buildings, etc. industrial sector (audits), firewood improved technologies, residential energy saving, laws,etc
- ❑ Developing national RE and EE industries
- ❑ Developing R&D institutes

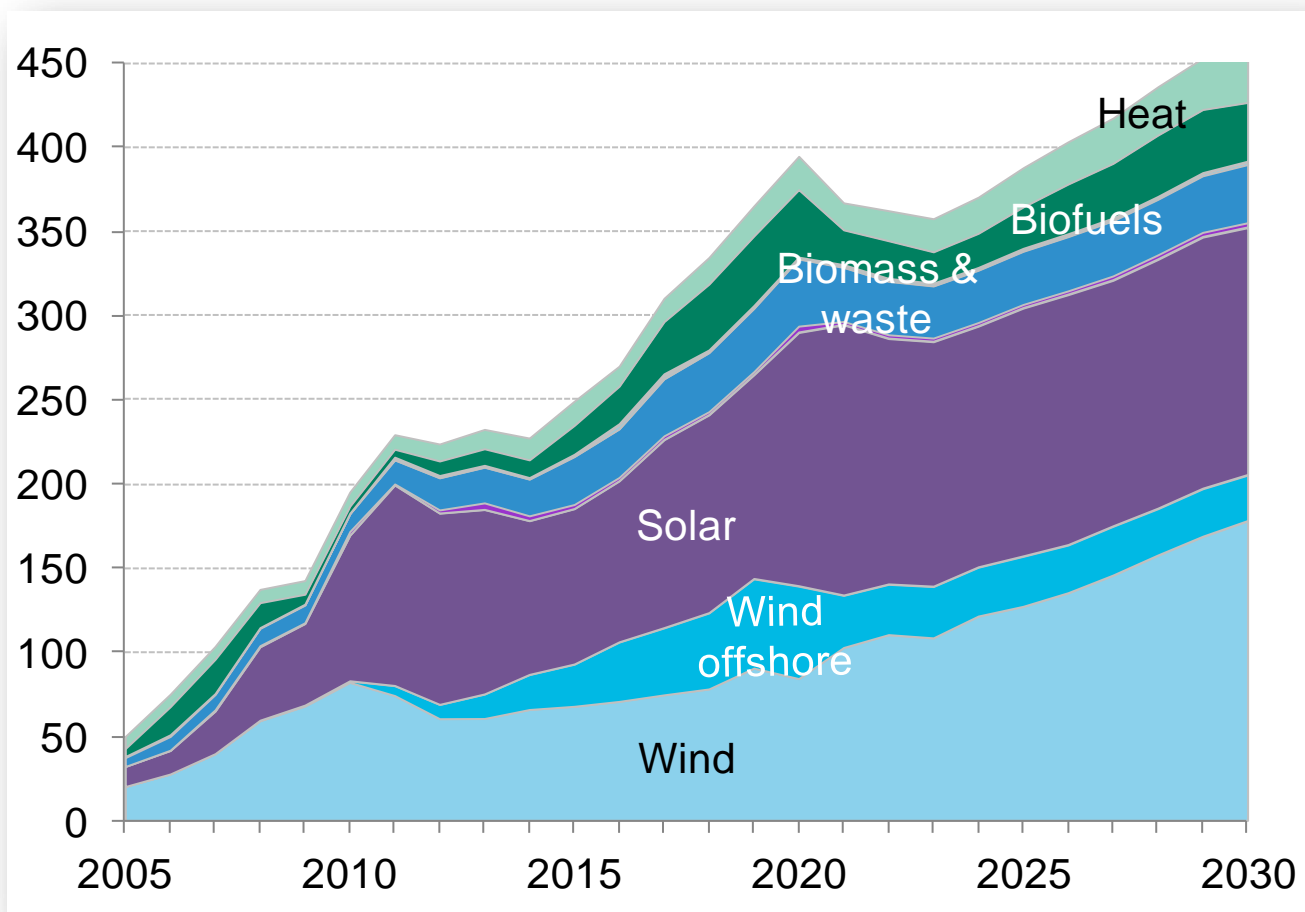


Part of the electricity production in 2011





## Annual value of renewable energy capacity installed by technology sector, 2005-30 (\$bn)



Source: Bloomberg New Energy Finance





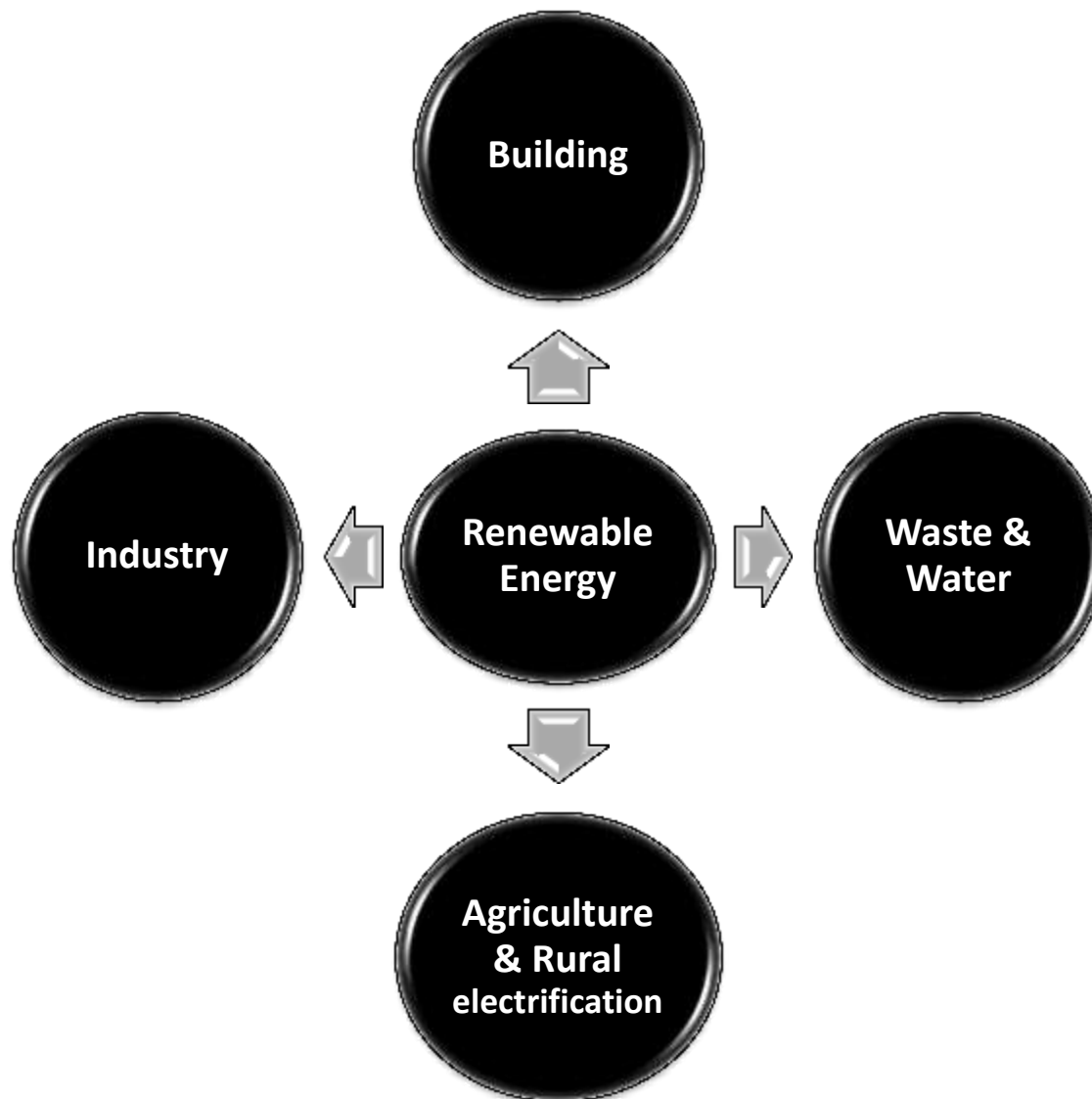
# Multiple benefits of renewables

## RE resources

- ❑ Several countries in the region have **no or very limited oil and gas** resources (Morocco, Tunisia, etc), while enjoy rich renewable resources.
- ❑ Huge RE potential in MENA countries (solar and wind)
- ❑ Reduce environmental stress (CO<sub>2</sub>, air pollution, no nuclear risk)
- ❑ Enhance security of supply (for non oil/Gas producers), reduce volatility of energy prices like oil
- ❑ Create green jobs
- ❑ Increase competitiveness of MENA economy
- ❑ Key for sustainable development



# RE in the productive sectors







## Main applications

**Large wind parks programs** : Morocco, Egypt, etc

**Solar water heating** : in domestic uses

**Hydropower** : Potentials from Dams and River-Run-Off Plants

**Small scale photovoltaic applications** are being widely used, mainly in rural areas telecommunication and road

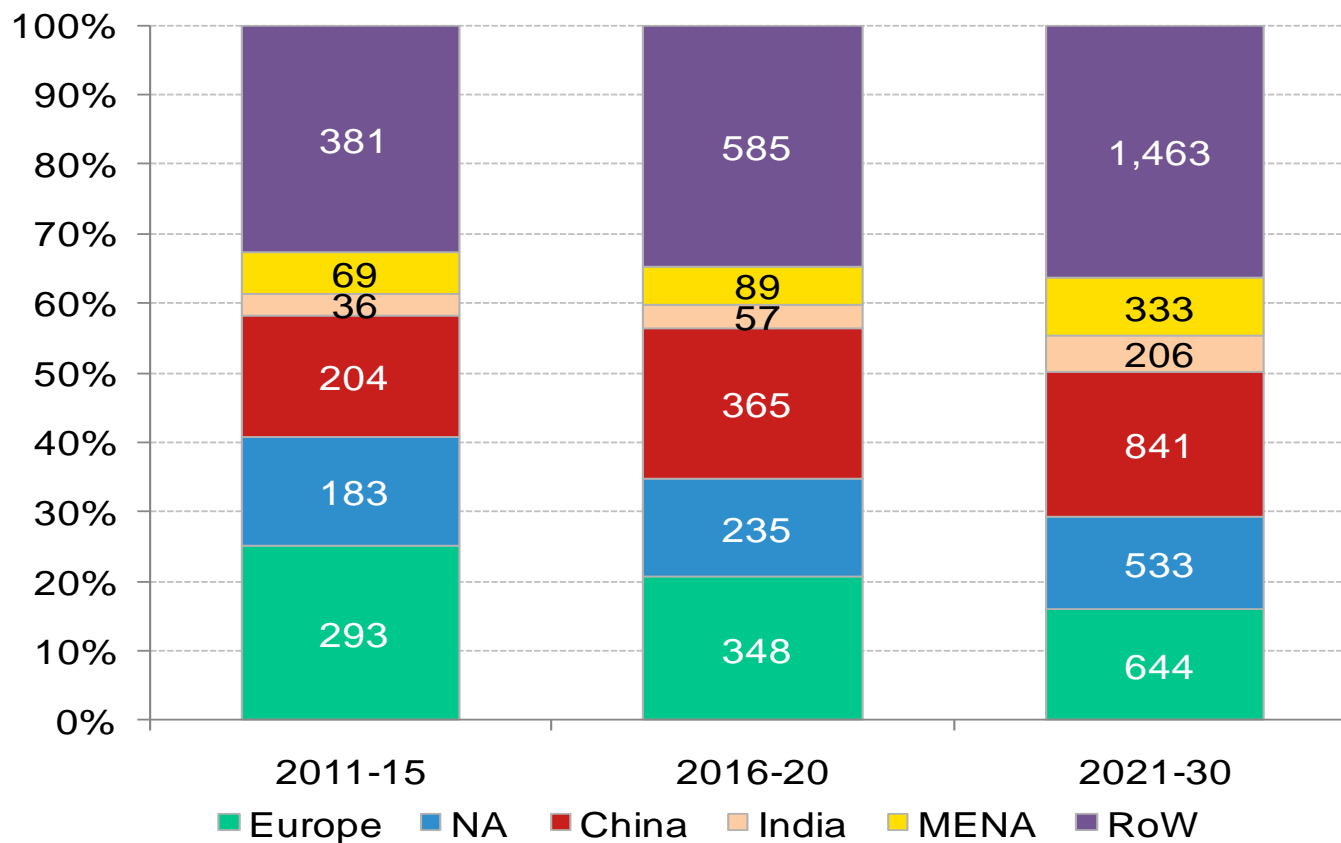
**Large scale CSP plants underway**: Morocco, Egypt, Algeria, etc

**Solar power desalination plants** have been demonstrated in Egypt, Jordan, etc

**But : Limited biomass applications**



## Investment in renewable energy in MENA region (\$bn)



Source: Bloomberg New Energy Finance



# RE integration in Industry

In recent years, renewable energy has increasingly attracted public and policy attention for its potential to contribute to energy supply. The use in **industrial applications** has received less interest.

The five options are in fact:

- ☐ Wind energy for producing electricity for large industrial companies : North Africa are best suited for utilizing wind energy (Morocco, Egypte,etc)
- ☐ Biomass for petrochemical and cement feedstocks
- ☐ Biomass for process heat
- ☐ Solar thermal systems for process : CSP technologies for high temperatures



## Barriers

**Lack of information on the potential contribution of renewable in industries**



**Cheap fossil fuels**



**Lack of technical capacity and capacities building**



**The high cost of investment**



## RE integration in Agriculture

### Technologies

To encourage agricultural businesses to install small scale renewable energy capacity, mainly for own consumption within the agricultural business as a way to help social and local development and improve business viability.

- ☐ **Biogas digesters** for cooking, lighting and fertilizer production
- ☐ **Pumping water using solar** power pumping water for irrigation : PV systems
- ☐ **Rural electrification through solar panels (SHS- Morocco PERG)** : lighting, pumping,etc
- ☐ **Buildings**; powering processing operations and others
- ☐ **Small-scale hydropower** : North Africa
- ☐ **Pumping water using wind** power (windmills)
- ☐ **Drying or curing farm produce**





## RE for Desalination

- ❑ The world water crisis is one of the largest public health issues of our time
- ❑ This is one of the huge problem in the MENA region . Part of this problem is caused by drought, which is expected to get worse in the future
- ❑ The coupling of renewable energy sources with desalination has the potential of providing a sustainable source of potable water, initially for end-users in arid areas with limited alternative solutions
- ❑ The rapid increase in fossil fuel costs have intensified the interest in the use of alternative energy sources
- ❑ RE -desalination will be part of the water supply in the near future



## Main technologies

Three main technologies are mature for MENA countries: solar distillation (solar still), PV and wind Reverse osmosis (*Brackish and sea water*)

	TYPICAL CAPACITY	ENERGY DEMAND	WATER GENERATION COST
SOLAR STILL	< 0.1 m <sup>3</sup> /d	solar passive	1–5 €/m <sup>3</sup>
PV-RO	< 100 m <sup>3</sup> /d	electrical: BW: 0.5–1.5 kWh/m <sup>3</sup> SW: 4–5 kWh/m <sup>3</sup> BW: 0.5–1.5 kWh/m <sup>3</sup> SW: 4–5 kWh/m <sup>3</sup>	BW: 5–7 €/m <sup>3</sup> SW: 9–12 €/m <sup>3</sup> SW: 9–12 €/m <sup>3</sup>
WIND-RO	50–2,000 m <sup>3</sup> /d	electrical: BW: 0.5–1.5 kWh/m <sup>3</sup> SW: 4–5 kWh/m <sup>3</sup>	units under 100 m <sup>3</sup> /d BW: 3–5 €/m <sup>3</sup> SW: 5–7 €/m <sup>3</sup> about 1,000 m <sup>3</sup> /d 1.5–4 €/m <sup>3</sup>

+

**Concentrating  
Solar Thermal  
Power:  
Electricity for  
desalination**





# RE from Waste

## MENA Ressources

**Waste from** : Agricultural waste, Commercial and industrial (Agro-Industries and paper industry), Animal Waste, Sugar Industry Wastes (bagasse), Liquid wastes, Municipal Solid Waste : *Millions of tons of household waste are collected each year with the vast majority disposed of in landfill dumps*

## Advantages

- ☐ Sustainable Electricity generation
- ☐ Job creation
- ☐ Availability of the solid and liquid wastes
- ☐ Reduced environmental impacts of municipal solid waste management
- ☐ Reduces greenhouse gas emissions



# Barriers

## Technology barriers

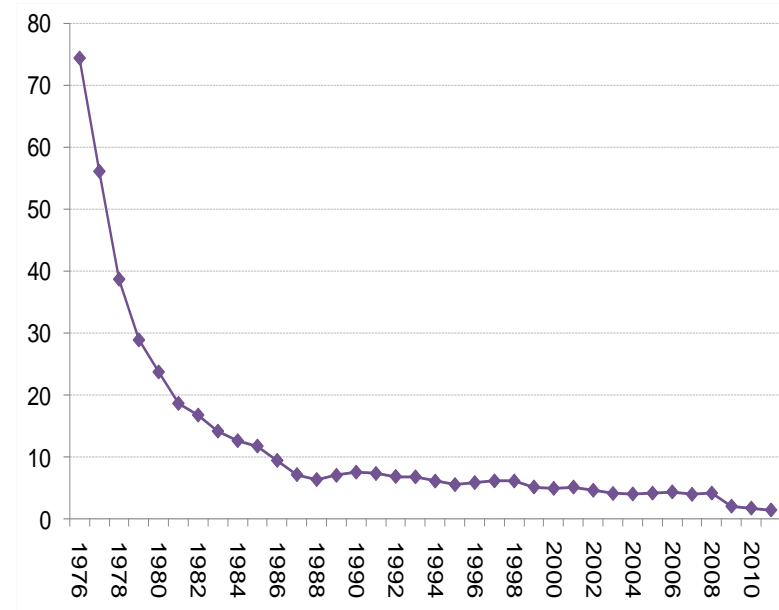
- ☐ Feedstock type
- ☐ Feedstock transportation costs
- ☐ Public perception
- ☐ Technology availability and technology risk
- ☐ Higher moisture content
- ☐ The availability of engineering
- ☐ Access to finance.



# RE for buildings

## Technology

- ❑ **Passive heat:** design of buildings so that less additional heating is required.
- ❑ **Solar thermal:** to provide hot water for homes or swimming pools
- ❑ **Photovoltaic energy (PV) :** to run appliances and lighting and/or for Grid-connected domestic systems
- ❑ **Off-grid systems for rural electrification :** are used to bring access to electricity to remote areas (households, pumping,etc)



PRICE OF CRYSTALLINE SILICON PV MODULES, 1976-JULY 2011  
(2010 \$/W)

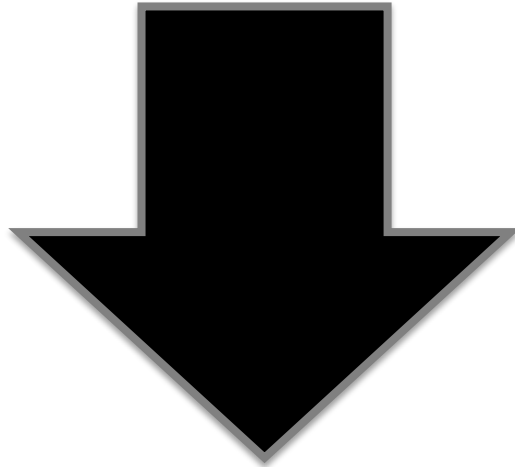


## RE for buildings

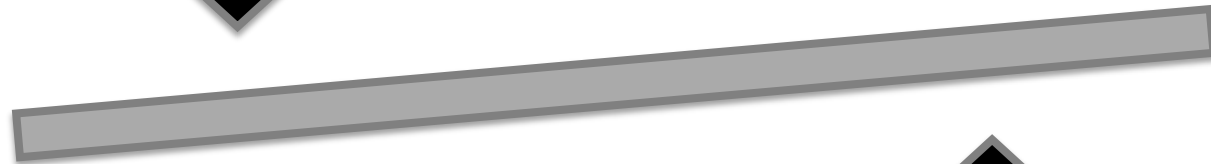
- ❑ **Buildings account for roughly 32%** of all energy consumption, more than transport or industry
- ❑ **It can be aesthetically integrated in buildings (PV,SWH).** It can cover roofs and facades contributing to reduce the energy buildings consume.
- ❑ **It creates thousands of jobs :** the PV sector, with an average annual growth of 20%
- ❑ **It contributes to improving the security of energy supply in MENA countries:** hundreds of thousands of buildings are constructed each year



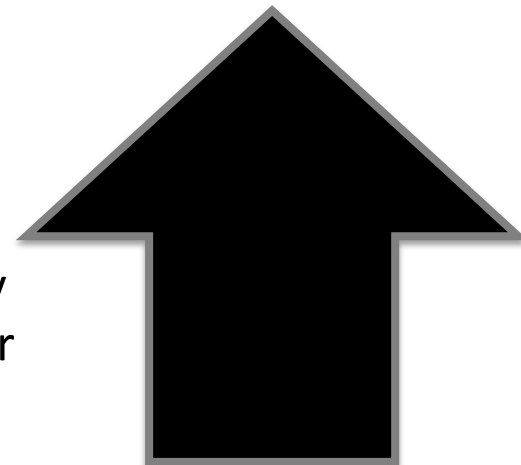
# Barriers



Policy must ensure that these technologies are brought to MENA countries



A transition **from conventional energy** systems to one based on **renewable resources** in MENA region is necessary to meet the ever-increasing demand for energy and to address environmental concerns





## The 21 century: the Renewable century

We have the  
financial  
resources

We have the  
natural  
ressources

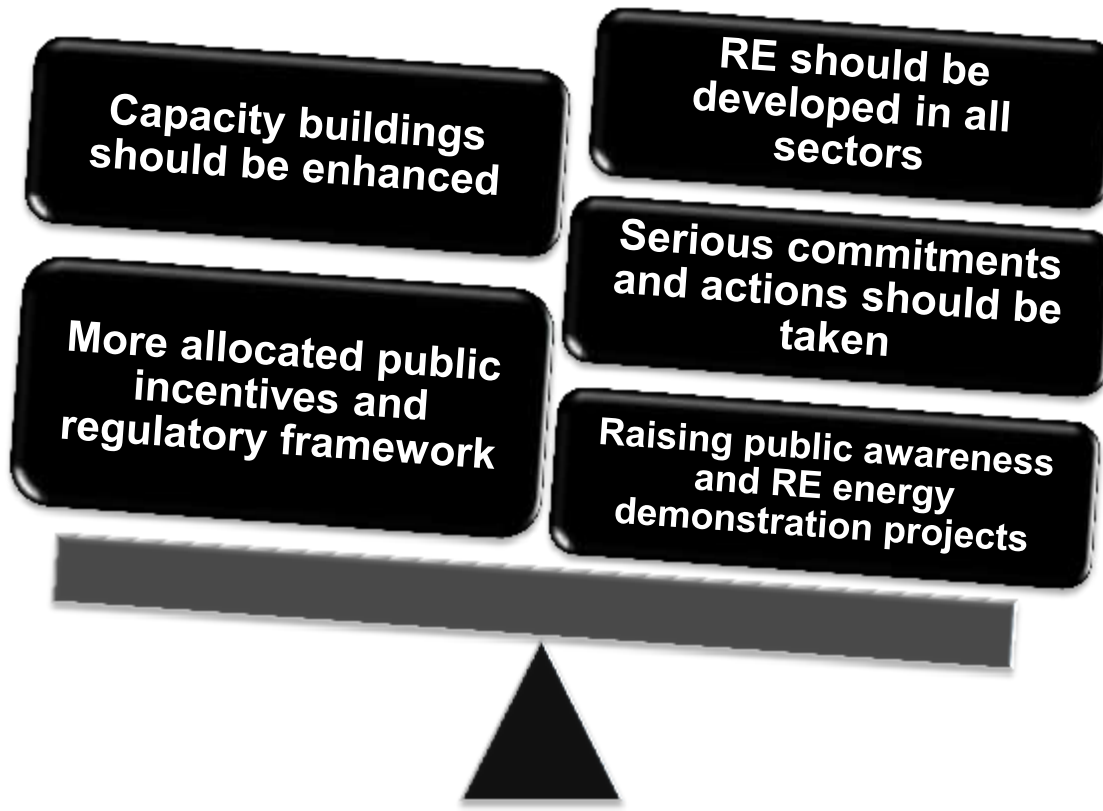
**Capacity buildings  
should be enhanced**

**RE should be  
developed in all  
sectors**

**More allocated public  
incentives and  
regulatory framework**

**Serious commitments  
and actions should be  
taken**

**Raising public awareness  
and RE energy  
demonstration projects**







***Thank you for your attention***

***s.mouline@aderee.ma***

